

IN THE CLAIMS:

✓ Please cancel Claim 1-124 without prejudice to or disclaimer of the subject matter contained therein, and add the following new claims:

- A17
125. A method for estimating, for each mobile station MS of a plurality of mobile stations, a location, L for MS using wireless signal measurements obtained from transmissions between the mobile station MS and a plurality of terrestrial communication stations, wherein each of said communications stations has one or more of each of a transmitter and a receiver for wirelessly communicating with the mobile station MS, comprising:
- 5 first receiving a request for locating the mobile station MS;
- second receiving, in response to said step of first receiving, one or more location hypotheses of the mobile station MS, wherein each location hypothesis includes a representation of a location estimate of the mobile station MS, and wherein said one or more location hypotheses are
- 10 determined using one or more MS location related outputs from one or more of location information determiners, wherein (A1) – (A2) following hold:
- (A1) for determining a corresponding portion of the location related outputs for the mobile station MS, each of said one or more location information determiners is dependent upon (I) and (II) following:
- 15 (I) at least some of a plurality of data instances, wherein, for each of a plurality geographical locations, there is one of the data instances having,
- (i) and (ii) following:
- (i) a representation of the geographical location, and
- (ii) multipath information of wireless signal data obtained using
- 20 transmissions between one of the mobile stations and the communication stations, wherein the one mobile station transmits from approximately the geographical location of (i); and
- (II) multipath data indicative of wireless signal multipath transmissions
- 25 between the MS and the communication stations;
- (A2) for each representation of a location estimate from said location information determiners, there is a corresponding collection of wireless receivers of the communication stations from which multipath data indicative of wireless signal multipath transmissions between MS and the corresponding collection of receivers
- 30 are used by the location information determiner for determining its location
- 0970828 10364
103210 8280260
- 9
- Q

related outputs, wherein for at least a first and a second representation of location estimates, their corresponding collections are different;

transmitting, to a predetermined destination, via a communications network, resulting information related to the location of the mobile station MS, wherein said resulting information is
35 obtained from said one or more MS location estimates of said location hypotheses.

126. The method of Claim 125, further including, determining the first representation of a location of MS by using, in addition to the multipath data from the corresponding collections of receivers, other wireless signal data indicative of wireless communication between the MS, and one or more of the receivers outside of the corresponding
5 collection for the first representation.

127. The method of Claim 125, wherein the first and second representations are provided by different first and second of the location information determiners.

128. The method of Claim 127, wherein for each of said first and second location information determiners there is a corresponding geographical area wherein substantially throughout the area, the location information determiner is able to determine an instance its portion of the location related outputs, and wherein the corresponding geographical areas for the
5 first and second location information determiners are different.

129. The method of Claim 125, wherein each of the one or more location hypotheses includes one or more of:

- (a) a value indicative of a likelihood of the MS being at the location estimate represented by the location hypothesis;
- 5 (b) an identifier for identifying the MS;
- (c) a representation of a likely point location of the MS;
- (d) a representation of a geographical area containing the MS;
- (e) an identification of one or more cells of a geographical partition, wherein the cells include a location estimate of MS;
- 10 (f) a timestamp indicative of when the wireless signal multipath transmission were received at the communication stations

130. The method of Claim 125, wherein the multipath data includes values indicative of measurements of at least two substantially simultaneous wireless transmissions from the MS that is received by one of the communication stations at different times.

131. The method of Claim 128, wherein the corresponding geographical areas for the first and second location information determiners include at least one of the communication stations in common, wherein the common communication station has a fixed location.

132. The method of Claim 125, wherein said step of second receiving includes determining, by at least one of said location information determiners a similarity between (i) and (ii) following: (i) the multipath data of (A1)(II), and (ii) the multipath information of (A1)(I)(ii) for a collection of one or more of the geographical locations.

133. The method of Claim 132, wherein said step of determining includes activating by the at least one location information determiner an artificial neural network for determining the similarity.

134. The method of Claim 127, wherein said step of second receiving includes activating the first and second location information determiners for locating the mobile station MS at substantially a same location.

135. The method of Claim 125, wherein: (a) the mobile station MS is land borne, (b) the communication stations and the mobile station MS communicate using one of: CDMA, TDMA, GSM, AMPS, and NAMPS, and (c) the communications network is one of a public switched telephone network and the Internet.

136. The method of Claim 125, wherein when determining the locations of the mobile station MS, each of the location information determiners change their corresponding portion of the location related outputs when there are changes to the at least some of the plurality of data instances

137. The method of Claim 125, wherein at least some of the receivers are co-located, and wherein there is a plurality of fixed location communication station sites each having a plurality of the receivers co-located therewith.

138. The method of Claim 125, further including a step of calibrating for at least some of the plurality geographical locations, (A1)(I)(i) with (A1)(I)(ii) using wireless signal transmissions to a GPS receiver substantially co-located with the one mobile station.

139. The method of Claim 125, wherein said step of second receiving includes a step of at least one of the location information determiners determining a value according to a consistency between (B1) and (B2) following:

(B1) values that are a function of at least one of: a signal strength and a signal time delay of wireless signals between said mobile station MS and the communication stations, and

(B2) values that are a function of at least one of signal strength and a signal time delay of wireless signals provided by multipath information of (A1)(I)(ii) for at least a collection of some of the data instances;

wherein an output from the determining step is dependent upon the representations (A1)(I)(i) of the collection of data instances.

140. The method of Claim 125, wherein at least some of said communication stations are substantially co-located with base stations of a commercial mobile radio service provider (CMRS), wherein each of said base stations support two way voice communication with the mobile stations via a plurality antennas at said base station, and the two way voice communication is provided by one of the following wireless transmission techniques: CDMA, TDMA, GSM, AMPS, and NAMPS.

141. The method of Claim 140, wherein at least some of said communication stations operatively use wireless transceivers at said base stations, wherein said transceivers support the two way voice communication with the mobile stations.

142. The method of Claim 125, wherein said one or more location related outputs are for substantially a same location of the mobile station MS, and further including a step of resolving location ambiguities between different MS location estimates obtained from the one or more location related outputs.

143. The method of Claim 140, wherein said one or more location related outputs are for substantially a same location of the mobile station MS, and further including a step of resolving location ambiguities between different MS location estimates obtained from the one or more location related outputs.

144. The method of Claim 143, wherein said step of resolving includes determining for each of one or more of said location information determiners, one or more of:

- (a) a corresponding likelihood value that said mobile station MS is within one of the location estimates obtained from the one or more location related outputs;
- 5 (b) a condition related to a corresponding velocity or change of velocity of the mobile station MS coinciding with one of the location estimates obtained from the one or more location related outputs;
- (c) a condition related to a corresponding terrain of one of the location estimates obtained from the one or more location related outputs; and
- 10 (d) a consistency with a previous location estimate of the mobile station MS.

145. The method of Claim 125, further including a step of resolving ambiguities between location estimates of the MS by performing a most likely location estimation procedure dependent upon said location estimates.

146. The method of Claim 145, wherein said step of performing a most likely location estimation procedure includes determining for each of one or more cells of a predetermined partitioning of an area containing said one or more location estimates, a value indicative of a likelihood of the mobile station MS being in the cell.

147. The method of Claim 143, wherein said step of resolving includes for at least one of said location information determiners performing a statistical technique for determining a likelihood of the mobile station MS being in an MS location estimate output by the at least one location information determiner.

148. The method of Claim 142, wherein said step of resolving includes detecting a clustering of at least some of said location estimates obtained from the one or more location related outputs for determining a most likely location of the mobile station MS.

149. The method of Claim 125, wherein at least one of said location information determiners (LID) uses input identifying of one of:

- (a) additional of said receivers not included in the corresponding receivers for LID that detect the mobile station MS, and
- (b) additional communication station transmitters not included in the corresponding receivers for LID that are detected by the mobile station MS.

150. The method of Claim 125, wherein at least some of said receivers are included in a base station network of a commercial mobile radio service provider, wherein there is a further step of requesting the mobile station MS to raise its transmission power.

151. The method of Claim 125, further including a step of calibrating at least one of said location information determiners using said plurality of data instances.

152. The method of Claim 125, wherein said step of transmitting includes outputting said resulting information using one of a public switched network and the Internet.

153. The method of Claim 125, wherein said step of first receiving includes obtaining the request from the Internet.

154. The method of Claim 125, wherein said step of first receiving includes requesting a location of the mobile station MS for one or more of:

- (1) locating a vehicle;
- (2) locating an emergency caller;
- (3) routing a vehicle;
- (4) locating a child;
- (5) locating livestock;
- (6) tracking a vehicle; and
- (7) locating a parolee.

155. The method of Claim 125, further including a step of determining the resulting information by snapping an intermediate location estimate for the MS, obtained from the MS location estimates, to a vehicle route near the intermediate location estimate.

cont A7

1.0567.0-560260

156. The method of Claim 125, further including the steps of:
requesting location information for the mobile station MS from one or more mobile
station location evaluators, wherein said location evaluators determine information related to one
or more location estimates of said mobile station MS when said location estimators are supplied
5 with corresponding input data having values obtained using wireless signals obtained via
transmissions between said mobile station MS and the communication stations, wherein the one
or more location evaluators perform one or more of the following steps:

- 10 (B1) estimating a location of said mobile station MS using values from a
corresponding instance of said input data obtained from timing signals received
at the mobile station MS from one or more satellites;
- (B2) determining at least one location area or locus for said mobile station MS using
timing measurements from a corresponding instance of said input data, wherein
the timing measurements are indicative of one of: a time of arrival of wireless
signals, and a time difference of arrival of wireless signals, wherein the wireless
15 signals are transmitted between the mobile station MS and at least one
communication station CS₁, wherein the signals for obtaining the timing
measurements are communicated during a plurality of wireless signal
transmissions between the mobile station and CS₁, with at least one of the
transmissions being from the mobile station to CS₁;
- 20 (B3) determining, for at least some one of the communication stations CS₂, a wireless
signal angle of arrival that is indicative of an angular orientation about the
communication station CS₂ of a direction of the wireless signal to CS₂ from the
mobile station MS;

obtaining, in response to the step of requesting, at least one output related to a location of
25 the mobile station MS from said one or more location estimators, wherein at least one of the steps
(B1) through (B3) is performed;

determining the resulting location information related to the mobile station MS using at
least one of: (a) a value obtained from said output related to the location of MS, and (b) said one
or more MS location estimates of said location hypotheses.

157. The method of Claim 125, further including the steps of:
requesting a location information for the mobile station MS from a mobile station
location evaluator, wherein said location evaluator determines information related to one or more
location estimates of said mobile station MS when said location estimator is supplied with

a

5 corresponding input data having values obtained by accessing wireless signals from transmissions between said mobile station MS and the communication stations, wherein the location evaluator performs the following step:

determining a statistical correlation for correlating (i) and (ii) following:

- (i) values obtain from the corresponding input data, and
- 10 (ii) information indicative of: a plurality of collections of wireless information between the communication stations and some one of the mobile stations, wherein for each of the collections, the wireless information includes one or more of the following data items:
 - (a) a make and model of the some one mobile station;
 - 15 (b) a representation of a location of the some one mobile station;
 - (c) a value indicative of a consistency of the collection with other collections;
 - (d) a value indicative of a signal strength and signal time delay measurement for wireless signal communications between one of the communication stations and the some mobile station at the location represented in (b);
 - 20 (e) a value indicative of a wireless signal frequency for wireless signal communications between one of the communication stations and the some mobile station at the location represented in (b);
 - (f) one or more wireless signal quality or error measurements of the wireless signal communications between one of the communication stations and
 - 25 the some mobile station at the location represented in (b);
 - (g) a value indicative of a noise ceiling of the wireless signal communications between one of the communication stations and the some mobile station at the location represented in (b);
 - 30 (h) a value indicative of a transmission power level of one or more of the one communication station in (e), and the some one mobile station;

wherein said correlation is used for determining that the mobile station MS is within a corresponding geographic area;

obtaining, in response to the step of requesting, at least one output related to a location of
35 the mobile station MS from said one or more location estimators, said determining step is performed;

determining the resulting location information related to the mobile station MS using at least one of: (a) a value obtained from said output related to the location of MS, and (b) said one or more MS location estimates of said location hypotheses.

158. An apparatus for estimating, for each mobile station MS of a plurality of mobile stations, a location, L for MS using wireless signal measurements obtained from transmissions between the mobile station MS and a plurality of terrestrial communication stations, wherein each of said communications stations has one or more of each of a transmitter and a receiver for wirelessly communicating with the mobile station MS, comprising:

one or more data repositories having a plurality of data instances, wherein, for each of a plurality geographical locations, there is one of the data instances having, (i) and (ii) following:

- (i) a representation of the geographical location, and
- (ii) multipath information of wireless signal data obtained using transmissions between one of the mobile stations and the communication stations, wherein the one mobile station transmits from approximately the geographical location of (i);

one or more of location information determiners for determining one or more MS location estimates, wherein (A1) – (A2) following hold:

(A1) for determining a corresponding portion of the location estimates for the mobile station MS, each of said one or more location information determiners is dependent upon (I) and (II) following:

- (I) at least some of a plurality of data instances from the one or more data repositories;
- (II) multipath data indicative of wireless signal multipath transmissions between the MS and the communication stations;

(A2) for each location estimate from said location information determiners, there is a corresponding collection of wireless receivers of the communication stations from which multipath data indicative of wireless signal multipath transmissions between the MS and the corresponding collection of receivers are used by the location information determiner for determining an MS location estimate, wherein for at least a first and a second MS location estimates, their corresponding collections are different;

an output interface operably connected to at least one communications network for transmitting, to a predetermined destination, resulting information related to the location of the

mobile station MS, wherein said resulting information is obtained using said one or more MS location estimates.

159. The apparatus of Claim 158, wherein the first and second MS location estimates are provided by different first and second of the location information determiners.

160. The apparatus of Claim 158, wherein at least one of the location information determiners determines a similarity between (i) and (ii) following: (i) the multipath data of (A1)(II), and (ii) the multipath information of (A1)(I)(ii) for a collection of one or more of the geographical locations.

161. The apparatus of Claim 160, wherein: (a) the mobile station MS is land borne, (b) the communication stations and the mobile station MS communicate using one of: CDMA, TDMA, GSM, AMPS, and NAMPS, and (c) the communications network is one of a public switched telephone network and the Internet.

162. The apparatus of Claim 158, wherein the first and second MS location estimates are for different locations of the MS.

163. The apparatus of Claim 159, wherein the first and second MS location estimates are for the same MS location.

164. The apparatus of Claim 158, further including an ambiguity resolver for resolving MS location ambiguity when there is a plurality of MS location estimates from the location information determiners.

165. The apparatus of Claim 164, wherein the resolver includes a most likelihood estimator for determining a most likely location of the MS obtained from the plurality MS location estimates.

166. The apparatus of Claim 164, wherein for a current instance of locating the MS, the resolver includes an adjuster for providing another MS location estimate that is dependent upon: (a) at least one of the plurality of MS location estimates obtained from a first of the location

information determiners, and (b) a previous performance of the first location information
5 determiner.

167. The apparatus of Claim 158, further including a storage for storing previously
determined MS location estimates so that the MS is able to be tracked.

168. The apparatus of Claim 158, wherein further including an MS location
information analyzer for determining an MS location attribute, including one or more of:

- (a) one or more of a velocity and acceleration estimate for the MS;
- (b) one or more extrapolated location estimates for the MS; and
- 5 (c) a path that the MS is travelling.

169. The apparatus of Claim 168, further including a comparison module for
comparing the MS location attribute for the first location estimate with the MS location attribute
for the second location estimate for reducing an ambiguity in the location of the MS.

170. The apparatus of Claim 158, further including a selector for selecting which of
the location information determiners to activate for locating the MS.

171. The apparatus of Claim 158, further including:

an interface for receiving location information for determining a location of the mobile
station MS;

one or more additional location information determiners, wherein said additional location
5 information determiners determine information related to one or more location estimates of said
mobile station MS when said location estimators are supplied with corresponding input data
having values obtained using wireless signals obtained via transmissions between said mobile
station MS and the communication stations, wherein the additional location information
determiners perform one or more of the following steps:

- 10 (B1) estimating a location of said mobile station MS using values from a
corresponding instance of said input data obtained from timing signals received
at the mobile station MS from one or more satellites;
- (B2) determining at least one location area or locus for said mobile station MS using
timing measurements from a corresponding instance of said input data, wherein
15 the timing measurements are indicative of one of: a time of arrival of wireless

signals, and a time difference of arrival of wireless signals, wherein the wireless signals are transmitted between the mobile station MS and at least one communication station CS₁, wherein the signals for obtaining the timing measurements are communicated during a plurality of wireless signal transmissions between the mobile station and CS₁, with at least one of the transmissions being from the mobile station to CS₁;

(B3) determining, for at least some one of the communication stations CS₂, a wireless signal angle of arrival that is indicative of an angular orientation about the communication station CS₂ of a direction of the wireless signal to CS₂ from the mobile station MS;

obtaining, in response to the step of requesting, at least one output related to a location of the mobile station MS from said additional location information determiners, wherein at least one of the steps (B1) through (B3) is performed;

determining the resulting information related to the mobile station MS using at least one of: (a) a value obtained from said output related to the location of MS, and (b) said one or more MS location estimates.

172. The apparatus of Claim 171, wherein one or more of the location information determiners and the additional location determiners transmit their corresponding location estimates via a TCP/IP network for subsequently determining the resulting information.

173. The apparatus of Claim 158, further including a group of modules for controlling a determining of a location of the MS, wherein one or more of the following are included:

- (a) modules for receiving location requests via the Internet; and
- (b) an access to output requirements for applications requesting location of the MS, wherein the output requirements include one or more of: an accuracy of a location estimate of the MS, and a frequency of determining a location estimate of the MS.

174. The apparatus of Claim 158, wherein at least some of said communication stations are substantially co-located with base stations of a commercial mobile radio service provider (CMRS), wherein each of said base stations support two way voice communication with the mobile stations via a plurality antennas at said base station, and the two way voice

5 communication is provided by one of the following wireless transmission techniques: CDMA, TDMA, GSM, AMPS, and NAMPS.

175. The apparatus of Claim 158, further including one or more vehicles, each vehicle having a satellite signal receiving receiver and one of the mobile stations, wherein the satellite signal receiving receiver determines a location of the vehicle, and the mobile station transmits wireless signals to the communication stations so that one or more of the plurality of data
5 instances corresponding to the location of the vehicle and the wireless signals are generated.

176. The apparatus of Claim 158, wherein one or more of the data instances include:

- (a) a make and model of the some one mobile station;
- (b) a representation of a location of the some one mobile station;
- (c) a value indicative of a consistency of the collection with other collections;
- 5 (d) a value indicative of a signal strength and signal time delay measurement for wireless signal communications between one of the communication stations and the some mobile station at the location represented in (b);
- (e) a value indicative of a wireless signal frequency for wireless signal communications between one of the communication stations and the some mobile station at the location represented in (b);
- 10 (f) one or more wireless signal quality or error measurements of the wireless signal communications between one of the communication stations and the some mobile station at the location represented in (b);
- (g) a value indicative of a noise ceiling of the wireless signal communications between one of the communication stations and the some mobile station at the location represented in (b);
- 15 (h) a value indicative of a transmission power level of one or more of the one communication station in (e), and the some one mobile station.

177. The apparatus of Claim 158, further including a data manager that purges data instances from the one or more data repositories by determining an inconsistency between the data instances for purging and other of the data instances in the data repositories.

178. The apparatus of Claim 158, wherein the first MS location estimate a timestamp associated therewith indicating a time or a date when the wireless signal multipath transmissions between the MS and the communication stations occurred.

179. The apparatus of Claim 158, wherein the predetermined destination uses the resulting information for one or more of:

- (1) locating a vehicle;
- (2) locating an emergency caller;
- (3) routing a vehicle;
- (4) locating a child;
- (5) locating livestock;
- (6) tracking a vehicle; and
- (7) locating a parolee.

180. The apparatus of Claim 158, wherein at least one of the location information determiners is adapts its output location estimates according to changes in said data instances of the data repositories.

181. The apparatus of Claim 158, further including a module for determining a value indicative of the MS being at the first location estimate.

182. The apparatus of Claim 183, further including a module for identifying areas having substantially inhibited wireless communication.

183. The apparatus of Claim 158, further including means for deriving a most likely location estimate of the MS, said most likely estimator uses a probability density function for fuzzifying at least a confidence value for the first location estimate over an area outside of said first location estimate.

184. A method for locating a mobile station MS, of a plurality of mobile stations, using wireless signal data obtained from transmissions between said mobile station MS and a plurality of fixed location receivers, wherein each said receiver is capable of at least wirelessly detecting said mobile stations, comprising :

b

centA17
FOIA b7 - DED 2/20

5 providing a plurality of data instances, wherein for each of a plurality geographical locations, there is one of said data instances having (a1) and (a2) following:

(a1) a representation of the geographical location,

(a2) corresponding multipath related information of wireless signal data obtained using transmissions between one of said mobile stations and said receivers, wherein the one mobile station transmits from approximately the geographical location of (a1);

10 providing a plurality of location estimators for locating the mobile stations, wherein for a set, C, having at least some of the location estimators, (b1) – (b3) following hold:

(b1) for each said location estimator of C, there is a predetermined corresponding collection of receivers from which the location estimator receives a corresponding input of wireless signal multipath data obtained from one of said mobile stations whose location is to be determined by the location estimator;

(b2) for determining locations of said mobile stations, each said location estimator of C is dependent upon (i) and (ii) following: (i) (a1) and (a2) of at least some of said data instances, and (ii) multipath information from wireless signals communicated between the mobile stations and said predetermined corresponding collection of receivers;

(b3) for at least two of said location estimators of C, their predetermined corresponding collections of receivers are different;

determining, using each of one or more of said location estimators of C, one or more location estimates of the mobile station MS when an occurrence of said wireless signal multipath data is obtained from wireless signals received from the mobile station MS by the corresponding collection of receivers;

transmitting, to a predetermined destination, via a communications network, resulting information related to the location of the mobile station MS, wherein said resulting information is obtained from said one or more of said location estimates.

185. The method of Claim 184, wherein when determining locations of the mobile stations, each of the location estimators of C change their location estimates when there are changes to the plurality of data instances.

186. The method of Claim 184, wherein at least some of the receivers are co-located, wherein there is a plurality of sites each having a plurality of the receivers co-located therewith.

187. The method of Claim 184, wherein said step of providing includes calibrating, for each of the plurality geographical locations, (a1) with (a2) using wireless signal transmissions from having a GPS receiver therein.

188. The method of Claim 184, wherein at least one of the location estimators performs the following step:

determining one or more likely location estimates for MS by identifying a similarity between (i) and (ii) following: (i) multipath characteristics determined from wireless signals communicated between the mobile station MS and the receivers, and (ii) the multipath information of (a2) for a collection of one or more of the geographical locations.

189. The method of Claim 184, wherein at least one of the location estimators performs the following step:

determining a value according to a consistency between (c1) and (c2) following:

(c1) values that are a function of at least one of: a signal strength and a signal time delay of wireless signals between said mobile station MS and the receivers, and

(c2) values that are a function of at least one of signal strength and a signal time delay of wireless signals provided by (a2) for at least some of the data instances;

wherein an output from the correlating step is dependent upon the representations (a1) of the at least some of the data instances.

190. The method of Claim 189, wherein the step of statistically correlating includes performing one of a statistical regression between (a2) for at least some of the data instances, and multipath information from wireless signals received for the mobile station MS

191. The method of Claim 184, wherein at least some of said receivers are substantially co-located with base stations of a commercial mobile radio service provider (CMRS), wherein each of said base stations support two way voice communication with the mobile stations via a plurality antennas at said base station, and the two way voice communication is provided by one of the following wireless transmission techniques: CDMA, TDMA, GSM, AMPS, and NAMPS.

192. The method of Claim 191, wherein at least some of said receivers are included within transceivers at said base stations, wherein said transceivers support the two way voice communication with the mobile stations.

193. The method of Claim 191, wherein said one or more location estimates are for substantially a same location of the mobile station MS, and further including a step of resolving location ambiguities between said location estimates.

194. The method of Claim 193, wherein said step of resolving includes determining for each of one or more of said location estimates, one or more of:

- (e) a corresponding likelihood value that said mobile station MS is within the location estimate;
- (f) a condition related to a corresponding velocity or change of velocity of the mobile station MS coinciding with the location estimate;
- (g) a condition related to a corresponding terrain of the location estimate; and
- (h) a consistency with a previous instance of locating the mobile station MS.

195. The method of Claim 193, wherein said step of resolving includes performing a most likely location estimation procedure using said location estimates for thereby determining a most likely location of the mobile station MS.

196. The method of Claim 195, wherein for at least some of the location estimators of C, their predetermined corresponding collections of receivers are different from one another, and the mobile station MS is terrestrial.

197. The method of Claim 193, wherein one or more of said location estimators includes a statistical prediction technique.

198. The method of Claim 193, wherein said step of resolving includes detecting a clustering of at least some of said one or more location estimates for determining a most likely location of the mobile station MS.

199. The method of Claim 193, wherein for each of said location estimators of C, said predetermined corresponding collection receivers has at least one of said receivers that is

different from said predetermined corresponding collection of receivers for a different one of said location estimators.

200. The method of Claim 184, wherein said step of determining includes obtaining a location estimate of the mobile station MS from less than all of said location estimators.

201. The method of Claim 200, wherein for each of at least some of said location estimators, the corresponding collection of receivers detects wireless multipath signals from a geographical area different from the predetermined corresponding collection of receivers for said at least some of said location estimators.

202. The method of Claim 201, wherein at least one of said one or more location estimators uses input indicative of additional of said receivers detecting the mobile station MS.

203. The method of Claim 184, wherein at least some of said receivers are included in a base station network of a commercial mobile radio service provider, wherein there is a further step of the commercial mobile radio service provider outputting a request for the mobile station MS to raise its transmission power.

204. The method of Claim 184, further including a step of calibrating at least one of said location estimators using said plurality of data instances.

205. The method of Claim 184 said step of transmitting includes outputting said resulting information using one of a public switched network and the Internet.

206. The method of Claim 205, further including a step of obtaining said resulting information from said one or more of said location estimates, wherein said step of obtaining includes one or more of:

- (c1) snapping a location of the mobile station MS to a vehicle traffic route;
- (c2) detecting a clustering of said one or more location estimates for determining a most likely location of the mobile station MS; and
- (c3) using, for each of said one or more location estimates, a corresponding likelihood value for determining said resulting information.

207. A method for locating a mobile station MS, of a plurality of mobile stations, using wireless signal data obtained from transmissions between said mobile station MS and a plurality of land borne wireless receivers, wherein each said receiver is capable of at least wirelessly detecting said mobile stations, comprising:

- 5 obtaining data indicative of wireless signal multipath at a plurality of known locations;
 deriving, for each of at least some of the plurality of known locations, corresponding multipath information indicative of the wireless signal multipath at the known location;
 storing, for each location L of the known locations, an instance of (a1) and (a2) following:

10 (a1) a representation of L, and

(a2) said corresponding multipath information, wherein said corresponding multipath information is indicative of the wireless signal multipath at the location L;

 activating one or more of a plurality of location estimators for determining one or more of location estimates of the mobile station MS, wherein (b1) – (b3) following:

15 (b1) for each said location estimator, there is a corresponding collection of receivers from which the location estimator receives a corresponding input of wireless signal multipath data when a location estimate of the mobile station MS is determined by the location estimator;

(b2) each of the location estimators performs a step of determining one or more likely location estimates for MS by identifying a similarity between (i) and
20 (ii) following: (i) multipath characteristics determined from wireless signals communicated between the mobile station MS and the corresponding collection of receivers, and (ii) the multipath information of (a2) for a collection of one or more of the locations;

25 (b3) for each of said location estimators, the corresponding collection of receivers is different from the corresponding collection of receivers for a different one of said location estimators;

 determining, from said one or more location estimates, a most likely location of the mobile station MS;

30 outputting, to a predetermined destination, via a communications network, resulting information related to the location of the mobile station MS, wherein said resulting information is obtained from said one or more of said location estimates.

208. The method of Claim 207, further including, for each of at least some of said one or more activated location estimators, the step of determining one or more likely location estimates identifies the similarity using at least one: a time value obtained from wireless multipath signals between the MS and the corresponding collection of receivers, a signal strength value obtained from wireless multipath signals between the MS and the corresponding collection of receivers, a value indicative of whether there is a wireless communication between the MS and a receiver not in the corresponding collection of receivers, and a difference in wireless signal data between MS transmissions at different transmission powers.

209. The method of Claim 204, wherein said step of identifying includes recognizing a pattern between (c1) and (c2).

210. The method of Claim 203, further including performing said three steps of obtaining, deriving and storing repeatedly, wherein at least one performance of said three steps occurs prior to said step of activating and another performance occurs after said step of activating.

211. The method of Claim 203, wherein at least some of said receivers are substantially co-located with base stations of a commercial mobile radio service provider (CMRS), wherein each of said base stations support two way voice communication with the mobile stations via a plurality antennas at said base station, and the two way voice communication is provided by one of the following wireless transmission techniques: CDMA, TDMA, GSM, AMPS, and NAMPS.

212. The method of Claim 203, further including a step of receiving a request for locating the mobile station for one or more of:

- (c1) locating a vehicle;
- (c2) locating an emergency caller;
- (c3) routing a vehicle;
- (c4) locating a child;
- (c5) tracking a vehicle; and
- (c6) locating a parolee.

213. An apparatus for locating a mobile station MS, of a plurality of mobile stations, using wireless signal data obtained from transmissions between said mobile station MS and a

plurality of wireless receivers, wherein each said receiver is capable of wirelessly detecting said mobile stations, comprising:

5 a data repository for storing, for each of a plurality of known locations, a plurality of instances of (a1) and (a2) following:

- (a1) a location representation of the known location, and
- (a2) corresponding multipath information, wherein said corresponding multipath information is indicative of the wireless signal multipath at the known location;

10 a plurality of location estimators for determining one or more of location estimates of the mobile station MS, wherein (b1) – (b3) following:

(b1) for each said location estimator, there is a predetermined corresponding collection of one or more of said receivers from which the location estimator receives a corresponding input of wireless signal multipath data obtained from one of said mobile stations whose location is to be determined by the location estimator;

15 (b2) for determining locations of said mobile stations, each said location estimator is dependent upon (i) and (ii) following: (i) (a1) and (a2) of at least some of said instances, and (ii) multipath information from wireless signals communicated between the mobile stations and said predetermined corresponding collection of said receivers;

20 (b3) for each of said location estimators, said predetermined corresponding collection has at least one of said receivers that is different from said predetermined corresponding collection for a different one of said location estimators;

25 a resolver for determining from said one or more location estimates a likely location of the mobile station MS.

214. The apparatus of Claim 213, wherein at least some of said receivers are substantially co-located with base stations of a commercial mobile radio service provider (CMRS), wherein each of said base stations support two way voice communication with the mobile station MS via a plurality antennas at said base station, and the two way voice communication is provided by one of the following wireless transmission techniques: CDMA, TDMA, GSM, AMPS, and NAMPS.

215. The apparatus of Claim 214, wherein at least some of said receivers are included within transceivers at said base stations, wherein said transceivers are able to support the two way voice communication with the mobile station MS.

216. The apparatus of Claim 215, further including an output gateway for transmitting, on one of a public telephone switching network and the Internet, an output indicative of said likely location to a predetermined destination, wherein said output gateway performs one or more of:

- 5
- (a) outputs said output in a format according to said predetermined destination;
 - (b) outputs said output according to a frequency for outputting said output; and
 - (c) determines said output by snapping said likely location to a transportation route.

217. The apparatus of Claim 215, wherein said resolver includes:
a location predictor for predicting a subsequent location of the mobile station MS by accessing data indicative of at least one estimated path for the mobile station MS.

218. The apparatus of Claim 215, wherein said resolver includes:
an evaluator for determining one or more of: (i) whether one of said location estimates implies that the mobile station MS has an excessive expected speed, (ii) whether one of said location estimates implies that the mobile station MS has an excessive expected speed for an area having
5 said one location estimate, (iii) whether one of said location estimates implies that the mobile station MS has an excessive expected change in velocity; (iv) whether one of said location estimates implies that the mobile station MS is travelling a known transportation pathway.

219. The apparatus of Claim 215, wherein said resolver includes:
an evaluator for determining a value indicative of a likelihood that the mobile station MS is at a corresponding one of said location estimates, wherein said evaluator determines said value as a function of a past performance of one of said location estimators that determined said
5 corresponding one of said location estimates.

220. The apparatus of Claim 215, wherein said resolver includes:
an evaluator for determining a value indicative of a likelihood that the mobile station MS is at a corresponding one of said location estimates, L, wherein said evaluator determines said value as a function of one of a similarity and a dissimilarity between one or more occurrences of said